

**KENWOOD**

# **SERVICE MANUAL**

**MODEL TL-911**



**LINEAR AMPLIFIER**

## FEATURES

Ample 2KW PEP input provides high power operation in SSB.

A class AB grounded-grid configuration with the regulated screen grid voltage is employed to assure stable, distortion-free SSB transmission. The linear switch can be set to CW for additional safety in CW (A1) operation.

An overcurrent detection type protection circuit is added to prevent heat trouble caused by abnormal operations and to assure safe tuning, which would be difficult with the TV-application tubes.

The plate currents in the power amplifier tubes can be monitored individually to facilitate determining which tube is defective when they develop flashing, low-emission trouble, etc.

A dynamic balance circuit is employed to make power sharing uniform among the power amplifier tubes. This enables all power tubes to serve with full efficiency and safety.

The ALC circuit is a dual type which controls both  $I_{g1}$  and  $I_{g2}$  for quality transmission over an extended dynamic range.

An SWR meter is provided for quick matching to the antenna.

A final tube box with efficient heat radiation and a large, powerful cooling fan (with a 6-vane) are employed to double the life of power tubes.

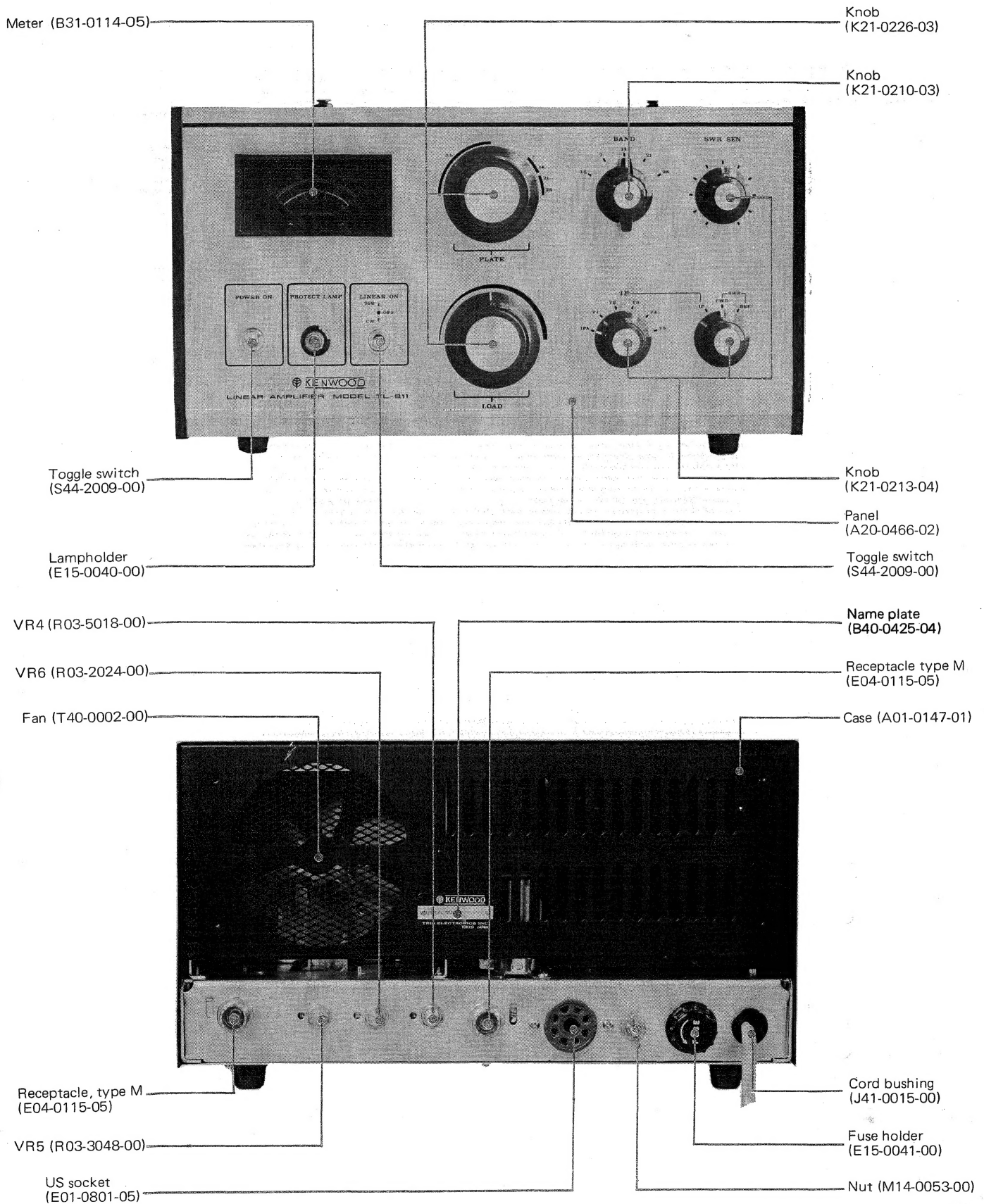
TL-911 is designed as a desk top type, the same construction as TS-515 transceiver so that they can be put together on a space-limited table.

Switching between exciter and linear amplifier operations is simple and accomplished by switching an antenna-through relay by means of the linear switch.

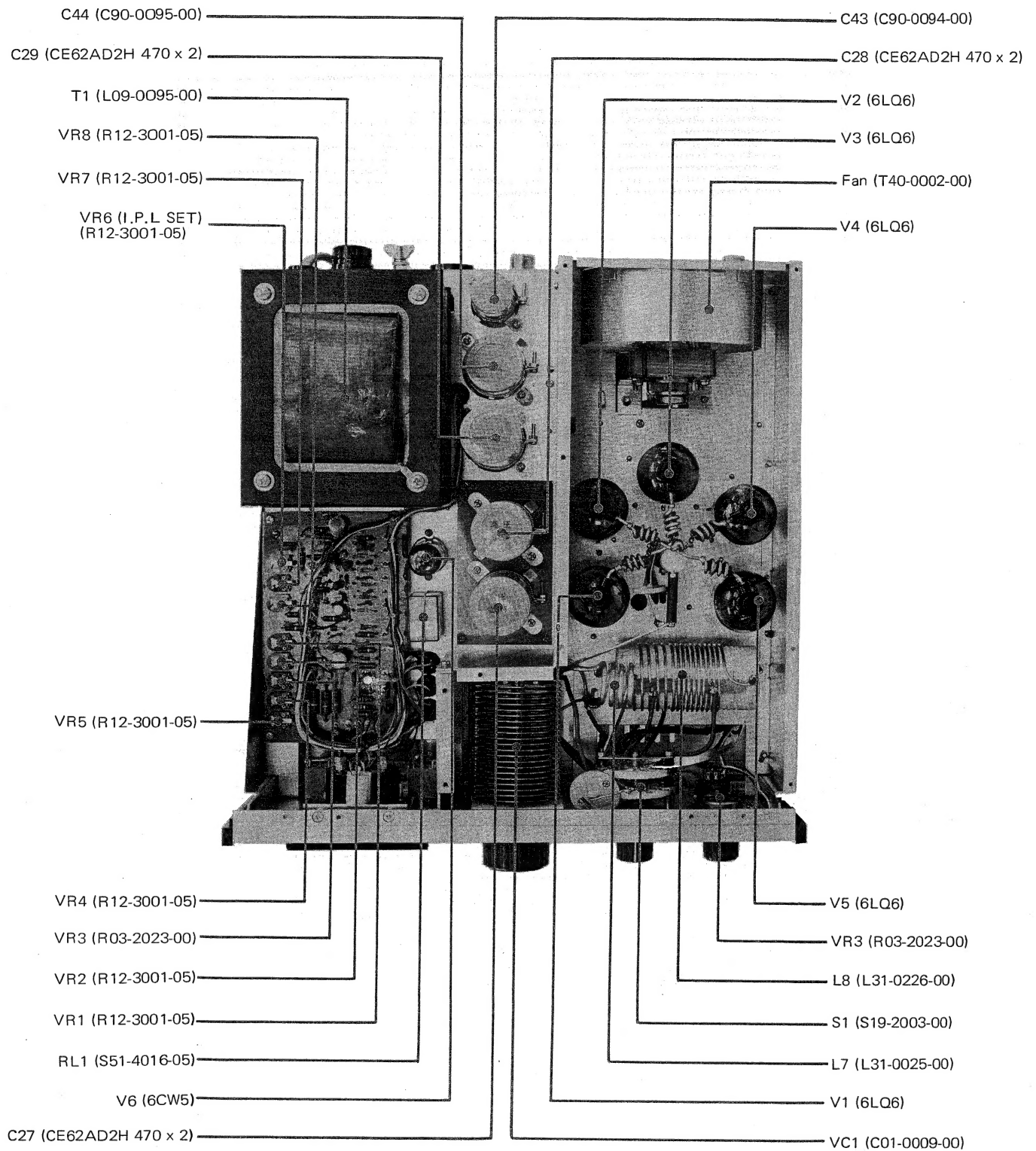
## CONTENTS

EXTERNAL VIEW .....	3
TOP CHASSIS VIEW .....	4
BOTTOM CHASSIS VIEW .....	5
CIRCUIT DESCRIPTION .....	6 ~ 8
TROUBLESHOOTING .....	9 ~ 10
CONNECTING REMOTE CABLE .....	11
ADJUSTMENT .....	12 ~ 15
VOLTAGE MEASUREMENTS OF TUBES AND TRANSISTORS .....	16
PARTS LIST .....	17 ~ 21
PC BOARD .....	22, 23
SCHEMATIC DIAGRAM .....	23
SPECIFICATIONS & COLOR CODE .....	24

## EXTERNAL VIEW

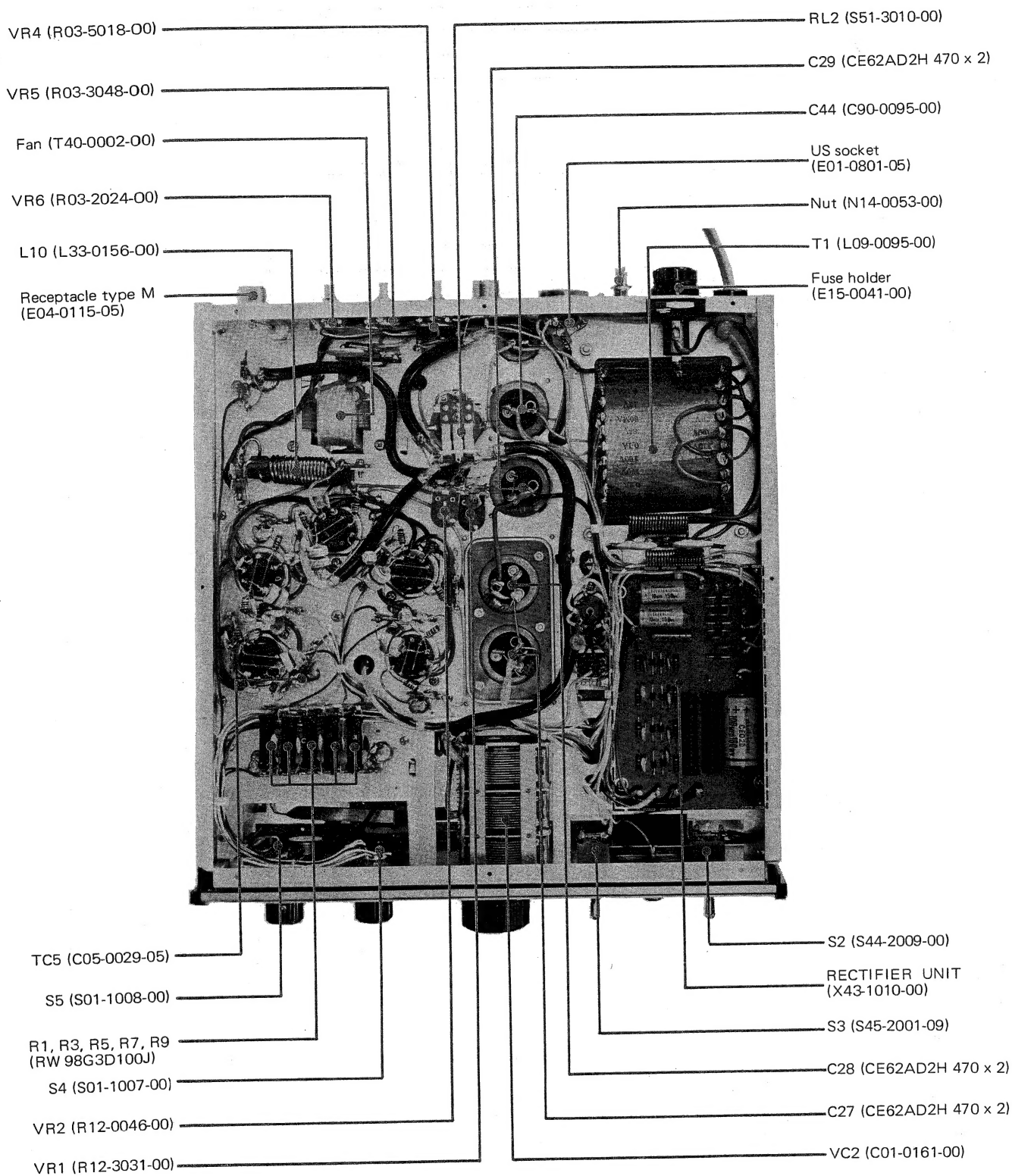


## TOP CHASSIS VIEW





## BOTTOM CHASSIS VIEW



## CIRCUIT DESCRIPTION

### □ OUTLINE

TL-911 linear amplifier circuit is shown in the block diagram of Fig. 1. The hybrid type amplifier employs 6 vacuum tubes, 3 transistors, 27 diodes, and 1 thyristor. The unitized sections are so arranged that each unit performs a different function of the amplifier, thus permitting the final amplifier section to be completely shielded, and the rectifier and control units independently mounted on the printed circuit boards, etc.

### □ FINAL POWER AMPLIFIER SECTION

The five 6LQ6 tubes are enclosed in a shielded box containing a powerful cooling fan. The tube operation is Class AB for SSB and Class C for CW in a grounded-grid configuration. The required bias switching is accomplished by means of the LINEAR ON switch. The screen grid voltage is obtained from a regulated power supply, thus assuring freedom from distortion. In addition, a dynamic balance circuit which maintains uniform dynamic characteristics among the power tubes, a dual type ALC circuit for improved linearity, and an SWR meter circuit are included.

### □ POWER SUPPLY SECTION

The individual supply voltages from a large power transformer having a current capacity more than actually required are rectified by rectifier unit X43-1010-00. The high voltage for the tube plates is obtained from a bridge rectifier composed of 8 diodes (10D10); voltage for the screen grids, bias circuit and relays are supplied by 10D4 and 10D1.

### □ OPERATION OF PROTECTION CIRCUIT

10 $\Omega$  resistors R1, R3, R5, R7, and R9 are inserted into the cathode of each power tube. When current flows through the cathodes, the resistors develop voltages, which are fed to the protection circuit through the diode matrix. Operation of the protection circuit, therefore, is determined by the cathode current.

The protection circuit is designed to operate when a cathode current of 240 mA continues for 20 seconds or more, or 400 mA or more flows instantaneously through a power tube.

If a 240 mA current flows through the cathode of one of the power tubes, a voltage (2.4 V) develops across the cathode and is applied to the input of the protection circuit to increase the potential across capacitor C16 (220 $\mu$ F). When this voltage increases to 1.2 V, it causes transistor Q3 to produce approximately 0.7 V across the emitter, which turns the thyristor on.

The thyristor turn-on results in actuation of relay RL1 connected to the collector of the transistor. Relay RL1 in turn removes the supply from relay RL2, which then supplies high negative voltages to the screen and control grids of the power tubes to cut the tubes off. The relay, at the same time, lights the protection lamp. Under this condition, the antenna output is automatically switched to exciter output. This operation is shown in Fig. 2.

When 400 mA or greater flows through a tube, the thyristor is turned on by the collector current of transistor Q2. The 400 mA causes the tube to develop 4 V across the cathode, and the voltage is applied to the emitter of Q2 through the diode matrix. This voltage at the emitter, however, is actually 3.7 V due to a voltage drop of 0.3 V across the diode. Now, since the transistor is adjusted to a base voltage of 3.0 V, the transistor develops

## CIRCUIT DESCRIPTION

0.7 V across the base-emitter junction — the same level as produced by the 240 mA fault current. Thus, the thyristor is turned on by this voltage to energize relay RL1, and protect the power tubes. To reset the protection circuit, shift the exciter stand-by switch to the receive mode or turn the LINEAR ON switch off. This procedure is necessary since relay RL2 has been self-held by "make" contacts since operation of relay RL1. The thyristor however has been automatically reset. Fig. 3 shows the operating characteristics of the protection circuit.

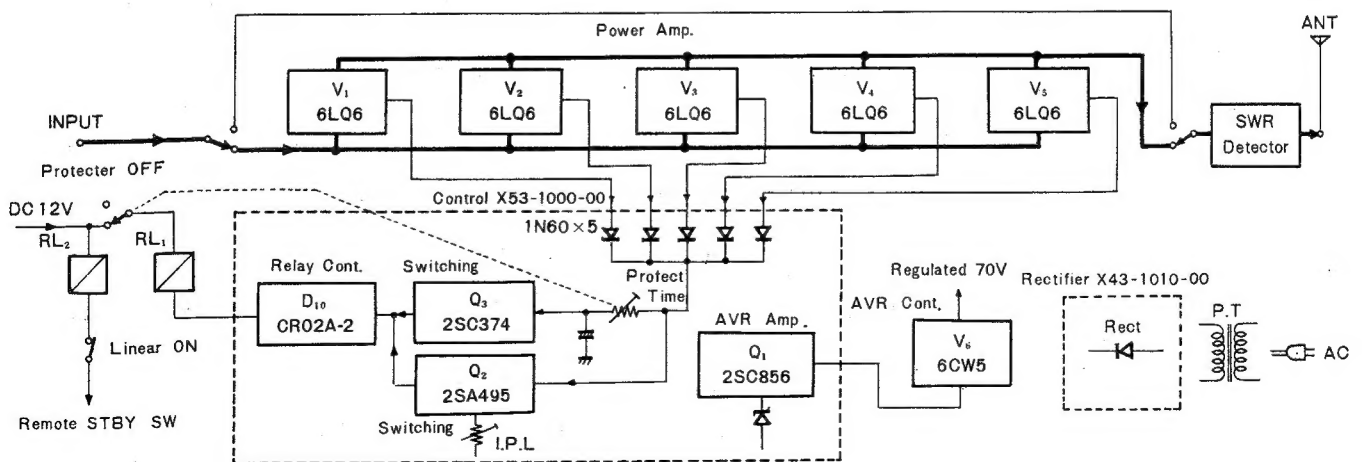


FIG. 1 BLOCK DIAGRAM

## CIRCUIT DESCRIPTION

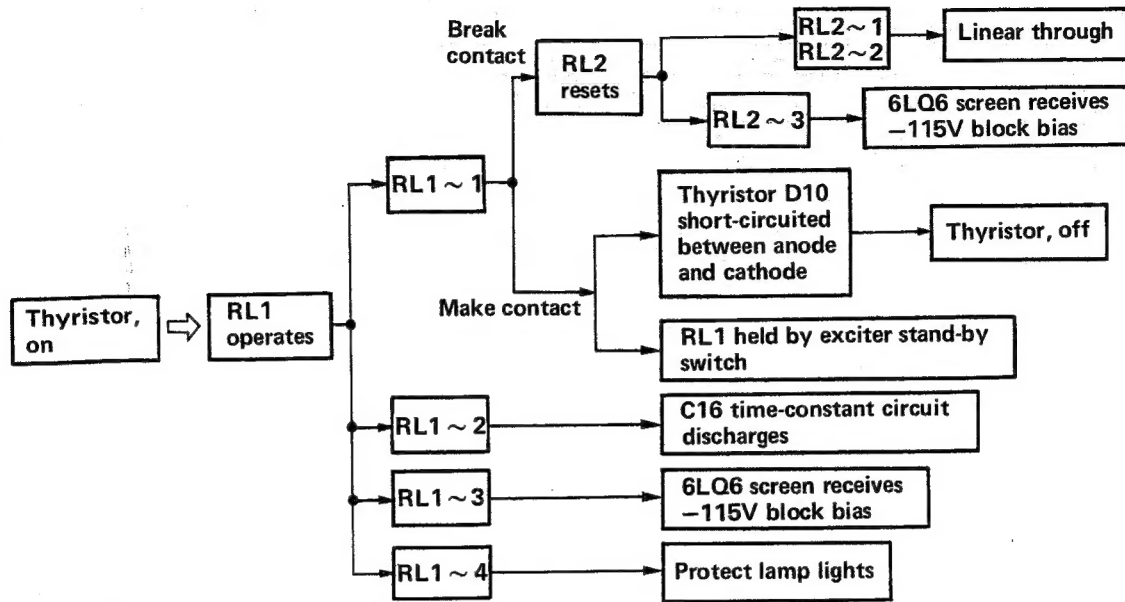


FIG. 2 OPERATION OF PROTECTION CIRCUIT

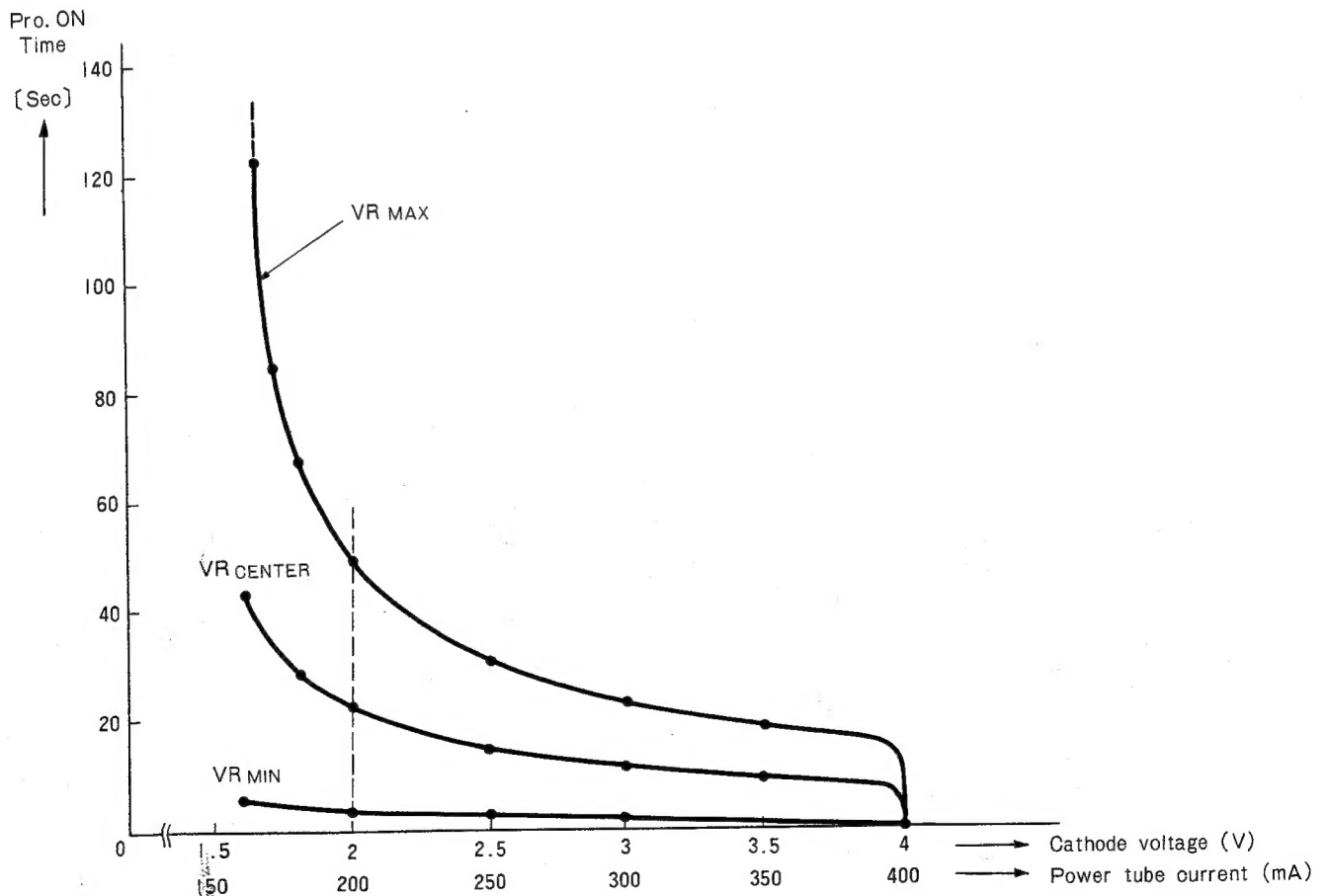


FIG. 3 PROTECTOR CHARACTERISTICS

## TROUBLESHOOTING

TROUBLE	CAUSE AND CORRECTIVE ACTION
(1) Linear amplifier does not operate in transmit mode.	<p>(a) Confirm that remote cable is connected to exciter. External stand-by circuit is inserted in series with TL-911 linear-on switch. Linear amplifier, therefore, will not operate by merely turning linear-on switch on. Linear amplifier is set to transmit mode by connecting remote cable to exciter, turning linear-on switch on, and exciter stand-by switch to transmit mode.</p> <p>(b) Is remote cable properly connected between exciter and linear amplifier? (Accessory remote cable is for TS-515 or TS-510. For use with other exciters, change pin connections, referring to CONNECTIONS OF REMOTE CABLE on page 11.)</p> <p>(c) Confirm that voltage is on in relay circuit.</p>
(2) Output meter does not deflect.	<p>(a) SWR SEN knob on panel is in fully counterclockwise position, or meter switch is not in FWD position. (SWR meter sensitivity is increased by turning SWR SEN knob in the clockwise direction.)</p> <p>(b) SWR detection circuit is inserted into coaxial cable connecting relay RL2 and antenna connector. Confirm that the circuit is rectifying RF voltage. Also check meter switch circuit.</p>
(3) Overcurrent protection circuit does not operate.	<p>(a) Protection circuit is turned off since PRO TIME knob on rear of set is set in the fully counterclockwise direction. <b>Note:</b> This knob should not be adjusted in normal operation. Power tubes may be damaged if transmission is continued with protection circuit off.</p> <p>(b) Confirm that the protection circuit is powered. (The voltage should be approximately DC 15 V at pin 28 of X53-1000-00.)</p> <p>(c) Protection will start only after an extended period at a plate current of around 150 mA. This, however, is not a trouble but is due to the operating characteristic of the protection circuit. See Fig. 3.</p>
(4) Overcurrent protection circuit trips too quickly.	<p>(a) Confirm that PRO TIME knob, on the rear, is set to proper operation time. (Refer to ALIGNMENT for the time adjustment.)</p> <p>(b) Rated exciter input to TL-911 is 100 W. If driven by more than 100 W, protection will trip more quickly than rated due to increase in <math>I_p</math>. See Fig. 3. Protection will trip quickly if transmission is continued at an <math>I_p</math> of around 300 mA. This, however, reduces the life of the power tubes, and drive should be reduced.</p> <p>(c) If linear amp tank circuit is improperly adjusted, plate dissipation will be greater under this condition. <math>I_p</math> will rapidly increase with the increase in tube temperature and protection will trip more quickly. This usage, in turn, imposes an extreme overload on the tubes, causing them to flash. The tank circuit, therefore, should be adjusted until tubes deliver maximum output for a given rate of plate current.</p>
(5) Protection circuit trips instantaneously when operator whistles into the microphone in the SSB mode or talks in a stronger voice.	<p>(a) This occurs from an overdrive in which whistling instantaneously swings <math>I_p</math> to 400 mA or greater. Although instantaneous, this large current will rapidly consume the life of power tube cathodes and exciter microphone gain should be reduced to avoid this.</p> <p>(b) Variable resistor VR6 contained in the control unit is set to an instantaneous protection level of below 400 mA. Readjust the potentiometer by referring to ALIGNMENT.</p>

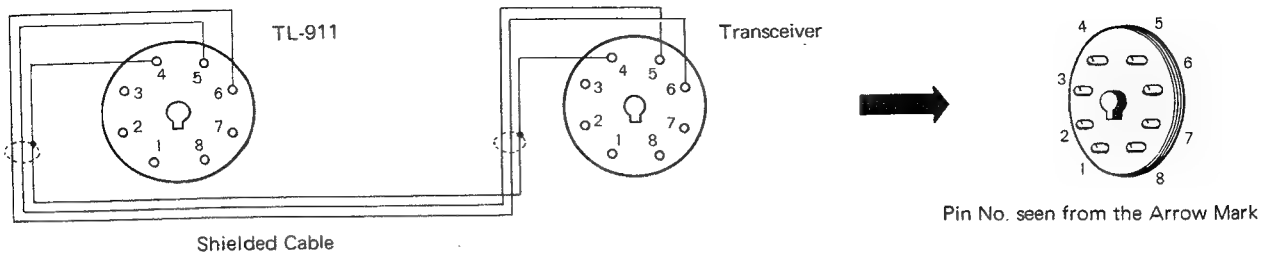


## TROUBLESHOOTING

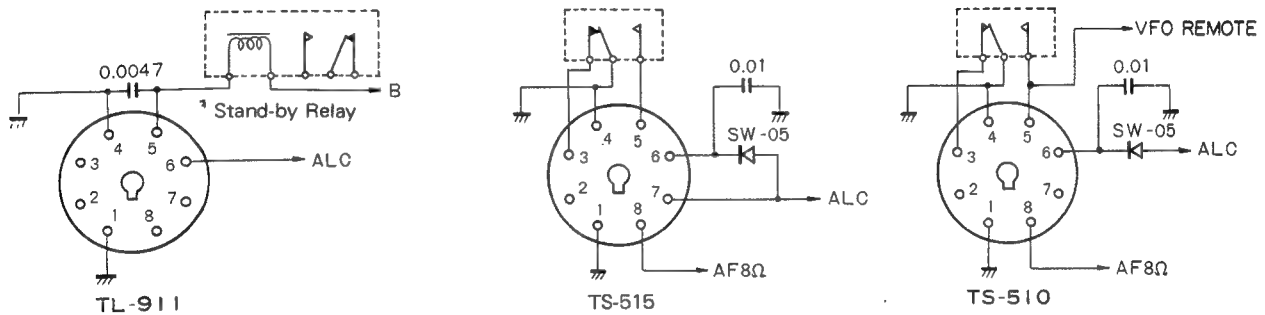
TROUBLE	CAUSE AND CORRECTIVE ACTION
(6) Linear amp output cannot be adjusted to a FWD scale peak on the SWR meter.	<p>(a) Meter switch is not set to SWR FWD position. If tank circuit is adjusted with improper meter switch position, <math>I_p</math>, plate dissipation will increase in proportion to meter deflection and is quite dangerous to tubes.</p> <p>(b) BAND switch is not positioned in the desired frequency band. There are two band switches — one on the exciter and the other on linear amplifier. With an improperly set band switch, the plate VC cannot be tuned and all plate input will be lost as plate dissipation. Transmission should be interrupted more than 10 seconds after protection circuit has tripped, to cool power tubes.</p> <p>(c) Tank circuit is not switched to correct frequency. Check band switch, and tank coils L7 and 8.</p> <p>(d) Plate stopping capacitor C22 (<math>0.002\mu/5</math> kV) is not electrically connected to plate choke coil L6 and tank circuit.</p>
(7) One or two tubes drain much more or less currents ( $I_p$ ) than the other tubes in the absence of signal.	<p>(a) Bias control potentiometer is improperly set. Readjust referring to ALIGNMENT.</p> <p><b>Note:</b> Bias can also become improper when line voltage is not AC 100 V. If line voltage is low, <math>I_p</math> is high and, if is high, <math>I_p</math> is low.</p>
(8) Plate current varies little with adjustment of dynamic balance trimmers.	<p>(a) The power tube is defective. This trouble often occurs with flash-damaged tubes. Replace with new tubes and readjust bias control potentiometer and trimmer while referring to ADJUSTMENT.</p>

## CONNECTING REMOTE CABLE

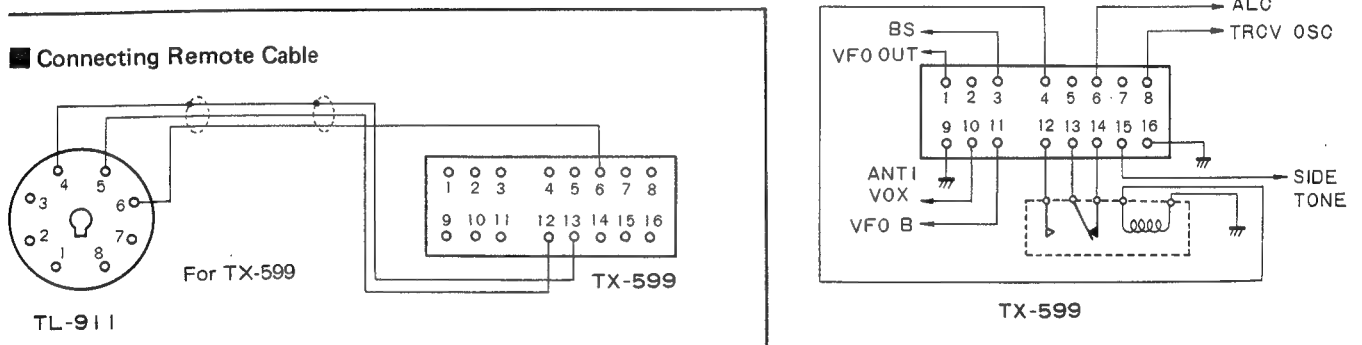
### ■ Connecting Remote Cable to TS-515



### ■ Connections of Remote Connector



### ■ Connecting Remote Cable



## ADJUSTMENT

### □ REQUIRED MEASURING INSTRUMENTS

1. **Voltmeter**  
Input resistance: 1M $\Omega$  or greater  
Voltage range: 1.5 through 1,000 V DC and AC  
A precision type multimeter may be employed. However, the multimeter will not give accurate readings when used for high impedance circuits (such as the ALC circuit).
2. **Stabilized supply**  
Output voltage: 2 V and above (must be capable of accurate voltages including 2.4 V, 4.0 V, and 7.5 V.  
Output current: 1.5 A or greater
3. **Power meter**  
Impedance: 50 or 75 $\Omega$   
Measuring power: 500 W or greater
4. **100 or 150 dummy resistor (non-inductive 50 W resistor) for SWR calibration**
5. **Precision type voltmeter**  
Class 0.5 with 2.4 V and 4.0 graticules
6. **Exciter**  
Frequency: 3.5 through 28 MHz  
Type of emission: SSB and CW

### □ ADJUSTMENT

#### 1. Screen grid voltage Esg. (V)

- (1) **Measuring instrument**  
Voltmeter
- (2) **Components to be adjusted**  
VR5 5k $\Omega$  (rear panel)
- (3) **Adjustment condition**
  - 1) Exciter stand-by switch: transmit
  - 2) Linear-on switch: SSB

**Note:** Screen grid voltage is approximately 80 V when linear amplifier is not operation.

- (4) **Adjustment method**  
Adjust VR5 until voltage at pin 1 or 7 of either one of tubes V1 through V5 is DC 70V.

#### 2. Base current Ip (static balance)

- (1) **Measuring instrument**
  - 1) Linear amp Ip meter
  - 2) Insulated screwdriver
- (2) **Components to be adjusted**  
Control unit (X53-1000-00) VR1 through VR5 10 k $\Omega$   
\* (See name plate on final shield box.)
- (3) **Adjustment conditions**
  - 1) Exciter mode: SSB
  - 2) Exciter stand-by switch: transmit

## ADJUSTMENT

- 3) Linear amp meter switch: Ip
- 4) Linear-on switch: SSB
- 5) Linear amp Ip switch: V1 through V5

**Note:** When linear-on switch is set to CW mode, power tubes receive deep bias at the grids and base current will not flow.

### (4) Adjustment method

Shift linear amp Ip switch to V1 through V5 and adjust the variable resistors so that each tube carries 15 mA at the individual switch positions. Read the currents on the Ip meter. (Line voltage must be an accurate 100 V during this adjustment.)

## 3. Plate current with input applied (dynamic balance)

### (1) Measuring instrument

- 1) Linear amp Ip meter
- 2) Dummy load or output meter
- 3) Insulated screwdriver (flat)
- 4) Metallic screwdriver (flat)

### (2) Components to be adjusted

- 1) TC1 through TC5 (rear of chassis)
- 2) VC1 (PLATE) and VC2 (LOAD) on panel

### (3) Adjustment conditions

- 1) Exciter mode: CW
- 2) Stand-by switch: transmit
- 3) Linear amp meter switch: Ip
- 4) Linear-on switch: SSB
- 5) Linear amp Ip switch : V1 thorough V5

**Note:** These adjustments must be made as quickly as possible. If the protector trips, allow more than 5 sec. before resetting, to cool the tubes.

### (4) Adjustment method

First adjust VC1 and VC2 so that a maximum output is obtained from single tone 7.15 MHz. Then, shift linear amp Ip switch V1 through V5, and check the individual Ip currents. In this adjustment, check for current irregularities among the tubes, and adjust TC1 through TC5 until the Ip drain of each tube is approximately 240 mA. Adjustment of one trimmer will effect another, thus, repeated adjustment 2 to 3 times is required. All tube currents however may not be exactly equal due to thermal drift. Irregularities of  $\pm 30$  mA are permissible.

## 4. Protection circuit

### (a) I.P.L. (instantaneous protection level adjustment)

#### (1) Measuring instrument

- 1) Stabilized power supply
- 2) Insulated screwdriver (flat)
- 3) Precision type voltmeter

#### (2) Components to be adjusted

- 1) Control unit (X53-1000-00)
- 2) VR6 10k $\Omega$  (I.P.L. SET)

\*(See nameplate on final shield box.)

#### (3) Adjustment condition

- 1) Disconnect remote cable extending to exiter, and shunt pins 4 and 5 of TL-911 remote socket.
- 2) Linear amp power switch; on
- 3) Linear-on switch; off

**Note:** Voltage across the cathode resistors must be 4V. Protector is reset by shifting linear-on switch to the on-position (CW or SSB) and then returning to the off-position.

## ADJUSTMENT

### (4) Adjustment method

Obtain a stabilized DC 4V power voltage calibrated with a precision type voltmeter. Apply this voltage across the cathode resistor ( $10\Omega$ ) of either one of power tubes V1 through V5. This voltage corresponds to 400mA cathode current. Then, adjust VR6 until the I.P.L. circuit instantaneously trips and protection lamp lights at the moment the 4V voltage is applied. When VR6 is turned in the counterclockwise direction, the protector will trip at a lower level.

The variable resistor must not be set at too low a level and it should be confirmed that the protector trips within 0.5 sec for 4.0V and 5 sec for 3.8V.

### (b) Protection time (PROTECT TIME)

#### (1) Measuring instrument

- 1) Stabilized power supply
- 2) Precision type voltmeter
- 3) Insulated screwdriver (flat)

#### (2) Components to be adjusted

- 1) VR4  $100k\Omega$  (PROTECT TIME) (rear of set)

#### (3) Adjustment conditions

Same as (a)

**Note:** Voltage across cathode resistor must be 2.4V.

#### (4) Adjustment method

Similar to (a), apply 2.4V across the cathode resistor, and adjust VR4 until the protector trips 20 sec after the voltage is applied. 2.4V corresponds to 240mA power tube cathode current.

## 5. Ip meter calibration

### (a) V1 through V5

#### (1) Measuring instrument

- 1) Stabilized power supply
- 2) Linear amp Ip meter
- 3) Insulated screwdriver (flat)

#### (2) Components to be adjusted

- 1) Control unit (X53-1000-00)  
VR7  $10k\Omega$

\*(See nameplate on final shield box.)

#### (3) Adjustment conditions

- 1) Exciter; off
- 2) Linear amp power switch; off
- 3) Linear amp meter switch; Ip
- 4) Ip switch; V1 through V5

#### (4) Adjustment method

Similar to (4), apply 2.4V across the cathode resistor, and adjust VR7 ( $10k\Omega$ ) until the Ip meter reads 240mA.

### (b) IPA

#### (1) Measuring instrument

Same as (a)

#### (2) Components to be adjusted

Control unit (X53-1000-00)  
VR8  $10k\Omega$

#### (3) Adjustment conditions

- 1) Exciter; off
- 2) Linear amp power switch; off
- 3) Linear amp meter switch; Ip
- 4) Ip switch; IPS



## ADJUSTMENT

### (4) Adjustment method

Apply DC 7.5V to terminal 16 of the rectifier unit (X43-1010-00), and adjust VR8 (10k $\Omega$ ) until the meter reads full scale value. The DC 7.5V corresponds to 1.5A power tube plate current.

## 6. SWR meter calibration

### (1) Measuring instrument

- 1) 50 $\Omega$  dummy
- 2) 100 $\Omega$  dummy
- 3) Linear amp SWR meter

### (2) Components to be adjusted

- 1) VR1 10k $\Omega$
- 2) VR2 500 $\Omega$   
(inside set)

### (3) Adjustment condition

- |       |                          |              |  |
|-------|--------------------------|--------------|--|
| A- 1) | Meter switch;            | FWD          |  |
| 2)    | Linear amp power switch; | off          |  |
| 3)    | Dummy load;              | 50 $\Omega$  |  |
| B- 1) | Meter switch;            | REF          |  |
| 2)    | Linear amp power switch; | off          |  |
| 3)    | Dummy load;              | 50 $\Omega$  |  |
| C- 1) | Meter switch;            | REF          |  |
| 2)    | Linear amp power switch; | off          |  |
| 3)    | Dummy load;              | 100 $\Omega$ |  |
| D- 1) | Meter switch;            | FWD          |  |

### (4) Adjustment method

- A. Pass exciter output directly to a 50 $\Omega$  (75 $\Omega$ ) dummy load not through the linear amplifier.  
The dummy load should be rated at 100W max at 14MHz.  
Then adjust exciter output to obtain a full scale reading on the SWR meter.
- B. Adjust VR2 (500 $\Omega$ ) until the meter reads minimum, then turn SWR SEN knob until the SWR meter reads "1".
- C. Replace the dummy load with a 100 $\Omega$  (or 150 $\Omega$ ) load, and supply a voltage which deflects the SWR meter to "2".
- D. Shift meter switch to FWD, and adjust VR1 (10k $\Omega$ ) until the meter reads maximum. When the meter switch is returned to REF under this condition, SWR meter should read "2". After confirmation, return meter switch to FWD and again replace the dummy load, with the 50 $\Omega$  (or 75 $\Omega$ ) load, then adjust SWR SEN knob until the meter deflects maximum. Return meter switch to REF and confirm that SWR meter reads "1". If there is an error readjust VR2 (500 $\Omega$ ) to obtain a minimum reading.
- \* If the first dummy is 75 $\Omega$  the second should be 150 $\Omega$  instead of 100 $\Omega$ .

# VOLTAGE MEASUREMENTS OF TUBES AND TRANSISTORS

## VACUUM TUBES

NOMENCLATURE	CATHODE (V) #3	CONTROL GRID (V) #2 and #6
6LQ6 (V1 thru V5)	$V = 1k \times 10\Omega$ 1k: Cathode current (A)	Linear- on switch, SSB $-35 \pm 10\%$ Linear- on switch CW $-75 \pm 20\%$ Linear- on switch, OFF $-75 \pm 20\%$ Protection, ON $-115$
6CW5 (V6)	70 (no load)	50 (no load)

NOMENCLATURE	SCREEN GRID (V) #1 and #7	SUPPRESSOR GRID (V) #8	PLATE (V)
6LQ6 (V1 thru V5)	Linear- on switch, SSB $+70 \pm 5\%$ Linear-on switch, CW $+70 \pm 5\%$ Linear-on switch, OFF $-80 \pm 20\%$ Protection, ON $-115$		$1350 \pm 5\%$
6CW5 (V6)	220 (no load)	70 (no load)	220 (no load)

## TRANSISTORS

NOMENCLATURE	BASE (V)	EMITTER (V)	COLLECTOR (V)
2SC856 (Q1)	20 (no load)	19 (no load)	50 (no load)
2SA495 (Q2)	3	$V = 1k \times 10$ 1k = Cathode current (A)	Protection, off 0 Protection, on 0.7
2SC374 (Q3)	Linear amp, off 0 Protection turns on at 1.2 0 while protection is on.	Protection, off 0 Protection, on 0.7	12

## PARTS LIST OF TL-911

Curcuit No.	Parts No.	Description	Remarks
—	A01-0147-01	Case	
—	A10-0283-01	Chassis	
—	A20-0466-02	Panel	
—	A40-0077-03	Bottom plate	
—	B01-0034-04	Side escutcheon (A)	
—	B01-0035-04	Side escutcheon (B)	
—	B07-0067-04	Meter escutcheon	
—	B19-0093-04	Acrylboard (B)	
P.L	B30-0045-00	Pilot Lamp (6V, 1.5W)	
P.L	B30-0046-05	Pilot lamp (6.3V)	
M	B31-0114-05	Meter	
—	B40-0425-04	Name plate	
—	B42-0009-04	Passed sticker	
—	B42-0287-04	High voltage caution plate	
—	B49-0036-04	Tubes layout plate	
—	B49-0037-04	Adjustment plate	
—	B50-0754-00	Operating manual	
—	E01-0801-05	US socket	
—	E01-0902-00	Vacuum tube socket	
—	E01-0903-05	9 pin miniature socket	
—	E03-0001-00	Plug (20A)	
—	E04-0115-05	Receptacle type M	
—	E05-0117-05	Plug type M	
—	E14-0801-05	US plug	
—	E15-0012-05	Polyvinyl chloride socket	
—	E15-0040-00	Pilot lamp bracket	
—	E18-1201-05	Relay socket	
—	E22-0208-05	Lug board	
—	E22-0407-05	Lug board	
—	E22-0509-00	Lug board	
—	E90-0001-00	Plate cap	
—	F02-0019-03	Fan duct	
F	F05-1532-00	Fuse (15A)	
—	F07-0204-03	Top cover	
—	F10-0219-13	Dashboard (A)	
—	F10-0220-13	Dashboard (B)	
—	F10-0221-04	Shield plate	
—	F20-0037-04	Insulator	
—	H20-0275-03	Protection cover	
—	J02-0005-04	Sub leg	
—	J02-0010-04	Leg	
—	J12-0048-05	Relay clamp	
—	J15-0041-00	Fuse holder	
—	J21-0392-04	Lead wire holder	
—	J21-0720-14	Meter stopper	
—	J21-0785-14	Fan stopper (A)	
—	J21-0786-14	Fan stopper (B)	
—	J21-0787-04	Tank coil stopper	

## PARTS LIST OF TL-911

Circuit No.	Parts No.	Description			Remarks
—	J21-0788-04	Heater choke stopper			
—	J41-0015-00	Power (line) cord bushing			
—	J42-0010-04	Rubber bushing			
—	J59-0001-05	Vinyl grommet			
—	J59-0002-05	Plunger			
—	K21-0210-03	Knob			
—	K21-0213-04	Knob			
—	K21-0226-03	Knob			
—	T40-0002-00	Motor (with fan)			
VC1	C01-0009-00	Variable capacitor (plate)			
VC2	C01-0161-00	Variable capacitor (load)			
TC1 ~ TC5	C05-0029-05	Ceramic trimmer			
C1 ~ C20	CK94YZ2H472P	Ceramic	0.0047 $\mu$ F	+100%, -0%	
C21	C90-0104-00	Ceramic	0.01 $\mu$ F	1.4kVW	
C22	C90-0105-00	Ceramic	0.002 $\mu$ F	5kVW	
C23	C90-0107-00	Ceramic	120PF	5kVW	
C24	C90-0106-00	Ceramic	330PF	2kVW	
C25,C26	CK94YZ2H472P	Ceramic	0.0047 $\mu$ F	$\pm$ 100%, -0%	
C27 ~ C29	CE62AD2H470X2	Electrolytic block	47 $\mu$ F	500WV	
C30 ~ C32	CK94YZ2H472P	Ceramic	0.0047	+100%, -0%	
C33,C34	CK94YZ2H103P	Ceramic	0.01 $\mu$ F	+100%, -0%	
C35 ~ C39	CK94YZ2H472P	Ceramic	0.0047 $\mu$ F	+100%, -0%	
C40 ~ C42	CK94YY3A103M	Ceramic	0.01 $\mu$ F	$\pm$ 20%	
C43	C90-0094-00	Electrolytic block	1000 $\mu$ F	25WV	
C44	C90-0095-00	Electrolytic block	100 $\mu$ F	315WV	
C45,C46	CK94YZ2H472P	Ceramic	0.0047 $\mu$ F	+100%, -0%	
C47	CK94YZ2H103P	Ceramic	0.01 $\mu$ F	+100%, -0%	
C48	C90-0106-00	Ceramic	330PF	2kVW	
C49	CK94YZ2H472P	Ceramic	0.0047 $\mu$ F	+100%, -0%	
C50,C51	CK94YZ2H103P	Ceramic	0.01 $\mu$ F	+100%, -0%	
R1	RW98G3D100J	Wire wound	10 $\Omega$	$\pm$ 5% 2W	
R2	RC05GF2H103K	Carbon	10k $\Omega$	$\pm$ 10% 1/2W	
R3	RW98G3D100J	Wire wound	10 $\Omega$	$\pm$ 5% 2W	
R4	RC05GF2H103K	Carbon	10k $\Omega$	$\pm$ 10% 1/2W	
R5	RW98G3D100J	Wire wound	10 $\Omega$	$\pm$ 5% 2W	
R6	RC05GF2H103K	Carbon	10k $\Omega$	$\pm$ 10% 1/2W	
R7	RW98G3D100J	Wire wound	10 $\Omega$	$\pm$ 5% 2W	
R8	RC05GF2H103K	Carbon	10k $\Omega$	$\pm$ 10% 1/2W	
R9	RW98G3D100J	Wire wound	10 $\Omega$	$\pm$ 5% 2W	
R10	RC05GF2H103K	Carbon	10k $\Omega$	$\pm$ 10% 1/2W	
R11	RC05GF2H391K	Carbon	390 $\Omega$	$\pm$ 10% 1/2W	
R12 ~ R14	RD14AY3A334K	Carbon	330k $\Omega$	$\pm$ 10% 1W	
V1 ~ V5		Tube	6LQ6		
V6		Tube	6CW5		
D1, D2		Diode	1N60		
D3		Diode	10D1		

## PARTS LIST OF TL-911

Circuit No.	Parts No.	Description	Remarks
VR1	R12-3031-00	PC trimmer potentiometer 10k $\Omega$ (B)	
VR2	R12-0046-00	PC trimmer potentiometer 500 $\Omega$ (B)	
VR3	R03-2023-00	Potentiometer 5k $\Omega$ (B)	
VR4	R03-5018-00	Potentiometer 100k $\Omega$ (B)	
VR5	R03-3048-00	Potentiometer 10k $\Omega$ (B)	
VR6	R03-2024-00	Potentiometer 5k $\Omega$ (B)	
L1~L5	L33-0153-00	Choke coil	
L6	L33-0155-00	Plate choke coil	
L7	L31-0025-00	Tank coil (1)	
L8	L31-0226-00	Tank coil (2) 28MHz	
L9	L33-0154-00	Choke coil	
L10	L33-0156-00	Heater choke coil	
L11, L12	L33-0157-00	Line filter	
L13, L14	L33-0032-05	Line filter	
LR1~LR10	R90-0003-00	Parasitic suppressor (grid)	
LR11~LR15	R90-0076-00	Parasitic suppressor (plate)	
T1	L09-0095-00	Power transformer	
RL1	S51-4016-05	Relay DC12V	
RL2	S51-3010-00	Relay DC12V	
S1	S19-2003-00	Rotary switch	
S2	S44-2009-00	Toggle switch	
S3	S45-2001-09	Toggle switch	
S4	S01-1007-00	Rotary switch	
S5	S01-1008-00	Rotary switch	



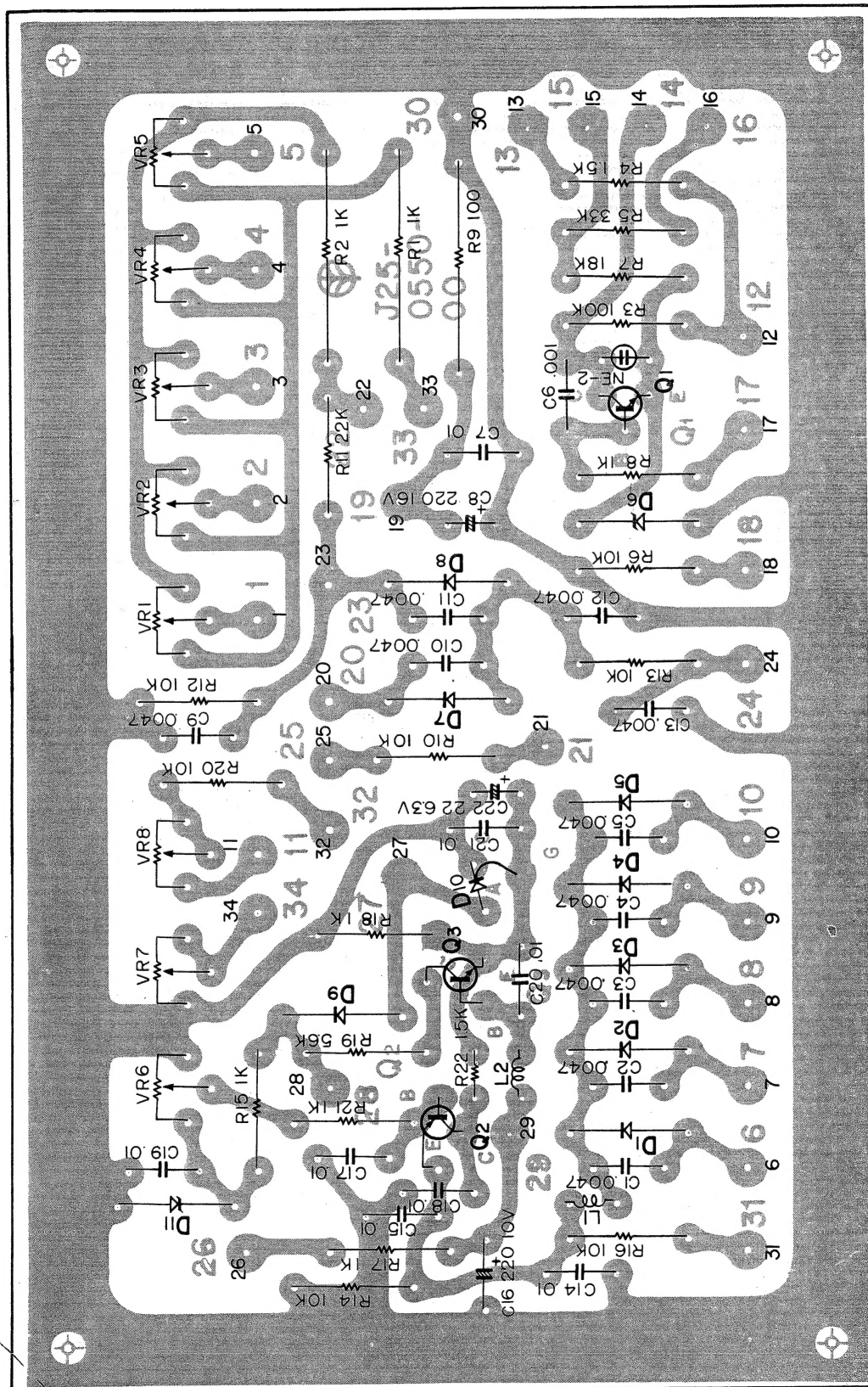
## PARTS LIST OF CONTROL UNIT X53-1000-00

Circuit No.	Parts No.	Description			Remarks
—	E23-0047-04	PC terminal			
—	J25-0550-00	PC board			
—		Neon bulb	NE — 2		
C1 ~ C5	CK94YZ1H472P	Ceramic	0.0047 $\mu$ F	+100%, —0%	
C6	CK94YZ2H102P	Ceramic	0.001 $\mu$ F	+100%, —0%	
C7	CK94YZ1H103P	Ceramic	0.01 $\mu$ F	+100%, —0%	
C8	CE04W1C221	PC electrolytic	220 $\mu$ F	16WV	
C9 ~ C13	CK94YZ1H472P	Ceramic	0.0047 $\mu$ F	+100%, —0%	
C14, C15	CK94YZ1H103	Ceramic	0.01 $\mu$ F	+100%, —0%	
C16	CE04W1A221	PC electrolytic	220 $\mu$ F	10WV	
C17 ~ C21	CK94YZ1H103P	Ceramic	0.01 $\mu$ F	+100%, —0%	
C22	CE04W0J220	PC electrolytic	22 $\mu$ F	6.3WV	
R1, R2	RC05GF3A102J	Carbon	1k $\Omega$	$\pm$ 5%	1W
R3	RC05GF2H104J	Carbon	100k $\Omega$	$\pm$ 5%	1/2W
R4	RC05GF2H152J	Carbon	1.5k $\Omega$	$\pm$ 5%	1/2W
R5	RC05GF2H333J	Carbon	33k $\Omega$	$\pm$ 5%	1/2W
R6	RC05GF2H103J	Carbon	10k $\Omega$	$\pm$ 5%	1/2W
R7	RC05GH2H183J	Carbon	18k $\Omega$	$\pm$ 5%	1/2W
R8	RC05FG2H102J	Carbon	1k $\Omega$	$\pm$ 5%	1/2W
R9	RC05GF3A101J	Carbon	100 $\Omega$	$\pm$ 5%	1W
R10	RC05GF2H103J	Carbon	10k $\Omega$	$\pm$ 5%	1/2W
R11	RC05GF2H223J	Carbon	22k $\Omega$	$\pm$ 5%	1/2W
R12 ~ R14	RC05GF2H103J	Carbon	10k $\Omega$	$\pm$ 5%	1/2W
R15	RC05GF2H102J	Carbon	1k $\Omega$	$\pm$ 5%	1/2W
R16	RC05GF2H103J	Carbon	10k $\Omega$	$\pm$ 5%	1/2W
R17, R18	RC05GF2H102J	Carbon	1k $\Omega$	$\pm$ 5%	1/2W
R19	RC05GF2H562J	Carbon	5.6k $\Omega$	$\pm$ 5%	1/2W
R20	RC05GF2H103J	Carbon	10k $\Omega$	$\pm$ 5%	1/2W
R21	RC05GF2H102J	Carbon	1k $\Omega$	$\pm$ 5%	1/2W
R22	RC05GF2H152J	Carbon	1.5k $\Omega$	$\pm$ 5%	1/2W
Q1		Transistor	2SC856		
Q2		Transistor	2SA495		
Q3		Transisotr	2SC374		
D1 ~ 5		Diode	IN60		
D6		Zenor diode	RD19A		
D7 ~ 9		Diode	10D1		
D10		Thyristor	CR02A-2		
D11		Zenor diode	RD-4A		
L1, L2	L33-0098-05	Ferri-inductor			
VR1 ~ VR8	R12-3001-05	PC trimmer potentiometer	10k $\Omega$ (B)		

## PARTS LIST OF RECTIFIER UNIT X43-1010-00

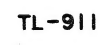
Circuit No.	Parts No.	Description				Remarks
—	E23-0047-04	PC terminal				
—	J25-0551-00	PC board				
C1 ~ C9	CK94YZ2H472P	Ceramic	0.0047 $\mu$ F	+100%, -0%		
C10, C11	CE02D2C100	Electrolytic tubular	10 $\mu$ F	160WV		
C12	CK94YZ2H472P	Ceramic	0.0047 $\mu$ F	+100%, -0%		
C13	CE02D2C101	Electrolytic tubular	100 $\mu$ F	160WV		
R1 ~ R8	RC05GF2H564K	Carbon	560k $\Omega$	$\pm$ 10%	1/2W	
R9, R10	RW98G2H100K	Wire wound	10 $\Omega$	$\pm$ 10%	5W	
R11	RC05GF3A102K	Carbon	1k $\Omega$	$\pm$ 10%	1W	
D1 ~ D8		Diode	10D10			
D9, D10		Diode	10D4			
D11 ~ D14		Diode	10D1			

# PC BOARD OF CONTROL UNIT X53-1000-00



Q1: 2SC856, Q2: 2SA495, Q3: 2SC374, D1~D5: IN60, D6: RD-19A, D7~D9: 10D1, D10: CR02A-2

331  
33 x 10' pft.



# SPECIFICATIONS

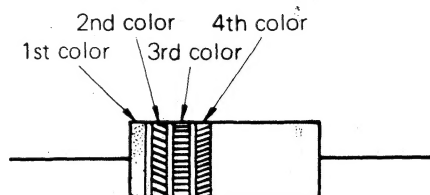
<b>FREQUENCY RANGE</b>	: 3.5 ~ 29.7 MHz (In 5 bands)
<b>MODE</b>	: SSB (A3j), CW (A1)
<b>POWER AMPLIFIER STAGE</b>	
<b>CIRCUITRY</b>	: SSB (Class AB), CW (Class C) Grounded-grid amplifier
<b>INPUT POWER</b>	: 2.0 kW PEP max.
<b>PLATE VOLTAGE</b>	: 1350 V $\pm 10\%$ (With no input signal)
<b>SCREEN GRID VOLTAGE</b>	: 70 V $\pm 5\%$
<b>CONTROL GRID VOLTAGE</b>	: - 35 V $\pm 10\%$ (SSB) - 75 V $\pm 20\%$ (CW)
<b>INPUT IMPEDANCE</b>	: 50 $\Omega$
<b>OUTPUT IMPEDANCE</b>	: 50 ~ 75 $\Omega$
<b>EXCITING POWER</b>	: 100 W
<b>PROTECTION CIRCUIT</b>	: Operates in 20 seconds at a cathode current of 240 mA per tube and instantaneously at 400 mA.
<b>VACUUM TUBES AND SEMI- CONDUCTORS</b>	: Vacuum tubes   6 Transistors   3 Diodes       27 Thyristor    1
<b>DIMENSIONS</b>	: 13-1/16" wide, 13-9/16" deep, 6-11/16" high
<b>WEIGHT</b>	: 40.7 lbs.
<b>POWER REQUIREMENT</b>	: 220 ~ 240 V AC, 50/60 Hz, less than 10 A at the rated input.



# COLOR CODE

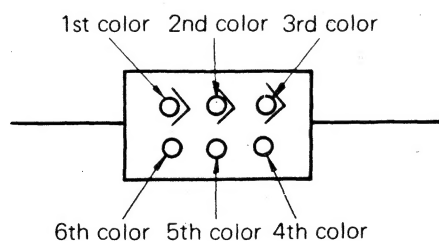
## RESISTOR

COLOR (meaning)	1st (value)	2nd (value)	3rd (multiplier)	4th (tolerance)
Black	0	0	$10^0$	—
Brown	1	1	$10^1$	$\pm 1\%$
Red	2	2	$10^2$	$\pm 2\%$
Orange	3	3	$10^3$	—
Yellow	4	4	$10^4$	—
Green	5	5	$10^5$	—
Blue	6	6	$10^6$	—
Purple	7	7	$10^7$	—
Grey	8	8	$10^8$	—
White	9	9	$10^9$	—
Gold	—	—	$10^{-1}$	$\pm 5\%$
Silver	—	—	$10^{-2}$	$\pm 10\%$
Non-color	—	—	—	$\pm 20\%$



## CAPACITOR (MICA)

COLOR (meaning)	1st (grade)	2nd (value)	3rd (value)	4th (multiplier)	5th (tolerance)	6th (characteristic)
Black	X	0	0	$10^0$	$\pm 20\%$	—
Brown	—	1	1	$10^1$	$\pm 1\%$	B
Red	Z	2	2	$10^2$	$\pm 2\%$	C
Orange	—	3	3	$10^3$	—	D
Yellow	—	4	4	$10^4$	—	E
Green	—	5	5	—	* $\pm 5\%$	—
Blue	—	6	6	—	—	—
Purple	—	7	7	—	—	—
Grey	Y	8	8	—	—	—
White	—	9	9	0.1	$\pm 10\%$	—



Unit = pF

\* Capacitance being less than 10pF is  $\pm 0.5\text{pF}$  on tolerance.